

10/019117

Practitioner's Docket No. SFK 20002 US**CHAPTER II**

Preliminary Classification:

Proposed Class:

Subclass:

NOTE: "All applicants are requested to include a preliminary classification on newly filed patent applications. The preliminary classification, preferably class and subclass designations, should be identified in the upper right-hand corner of the letter of transmittal accompanying the application papers, for example 'Proposed Class 2, subclass 129.'" M.P.E.P., § 601, 7th ed.

**TRANSMITTAL LETTER
TO THE UNITED STATES ELECTED OFFICE (EO/US)
(ENTRY INTO U.S. NATIONAL PHASE UNDER CHAPTER II)**

PCT/US00/17933	29/06/2000	29/06/1999
INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
HEMMING APPARATUS AND METHOD		
TITLE OF INVENTION		
STEFANEK, Ronald C.		
APPLICANT(S)		

Box PCT
Assistant Commissioner for Patents
Washington D.C. 20231
ATTENTION: EO/US

CERTIFICATION UNDER 37 C.F.R. §§ 1.8(a) and 1.10*

(When using Express Mail, the Express Mail label number is mandatory;
Express Mail certification is optional.)

I hereby certify that, on the date shown below, this correspondence is being:

MAILING

☒ deposited with the United States Postal Service in an envelope addressed to the Assistant Commissioner for Patents, Washington, D.C. 20231

37 C.F.R. § 1.8(a)**37 C.F.R. § 1.10 ***

☐ with sufficient postage as first class mail.

☒ as "Express Mail Post Office to Addressee"

Mailing Label No. EL852784566US (mandatory)

TRANSMISSION

☐ facsimile transmitted to the Patent and Trademark Office, (703) _____

Date: 12/21/01

Audrey M. Dragony
Signature

Audrey M. Dragony

(type or print name of person certifying)

* Only the date of filing (§ 1.6) will be the date used in a patent term adjustment calculation, although the date on any certificate of mailing or transmission under § 1.8 continues to be taken into account in determining timeliness. See § 1.703(f). Consider "Express Mail Post Office to Addressee" (§ 1.10) or facsimile transmission (§ 1.6(d)) for the reply to be accorded the earliest possible filing date for patent term adjustment calculations.

(Transmittal Letter to the United States Elected Office (EO/US) [13-18]—page 1 of 9)

100119117 0351702
10/019117
531 Rec'd PCT/PT 21 DEC 2001

NOTE: To avoid abandonment of the application, the applicant shall furnish to the USPTO, not later than 20 months from the priority date: (1) a copy of the international application, unless it has been previously communicated by the International Bureau or unless it was originally filed in the USPTO; and (2) the basic national fee (see 37 C.F.R. § 1.492(a)). The 30-month time limit may not be extended. 37 C.F.R. § 1.495.

WARNING: Where the items are those which can be submitted to complete the entry of the international application into the national phase are subsequent to 30 months from the priority date the application is still considered to be in the international state and if mailing procedures are utilized to obtain a date the express mail procedure of 37 C.F.R. § 1.10 must be used (since international application papers are not covered by an ordinary certificate of mailing—See 37 C.F.R. § 1.8.

NOTE: Documents and fees must be clearly identified as a submission to enter the national state under 35 U.S.C. § 371 otherwise the submission will be considered as being made under 35 U.S.C. § 111. 37 C.F.R. § 1.494(f).

I. Applicant herewith submits to the United States Elected Office (EO/US) the following items under 35 U.S.C. § 371:

- a. ☒ This express request to immediately begin national examination procedures (35 U.S.C. § 371(f)).
- b. ☒ The U.S. National Fee (35 U.S.C. § 371(c)(1)) and other fees (37 C.F.R. § 1.492) as indicated below:

(Transmittal Letter to the United States Elected Office (EO/US) [13-18]—page 2 of 9)

100019117 DEC 17 2001

10/019117

531 Rec'd PCT/PTC 21 DEC 2001

2. Fees

CLAIMS FEE	(1) FOR	(2) NUMBER FILED	(3) NUMBER EXTRA	(4) RATE	(5) CALCULATIONS
<input type="checkbox"/> *	TOTAL CLAIMS	28 - 20 =	8	× \$18.00 =	\$144.00
	INDEPENDENT CLAIMS	5 - 3 =	2	× \$84.00 =	168.00
	MULTIPLE DEPENDENT CLAIM(S) (if applicable) + \$280.00				
BASIC FEE**	<input checked="" type="checkbox"/> U.S. PTO WAS INTERNATIONAL PRELIMINARY EXAMINATION AUTHORITY Where an International preliminary examination fee as set forth in § 1.482 has been paid on the international application to the U.S. PTO: <input type="checkbox"/> and the international preliminary examination report states that the criteria of novelty, inventive step (non-obviousness) and industrial activity, as defined in PCT Article 33(1) to (4) have been satisfied for all the claims presented in the application entering the national stage (37 C.F.R. § 1.492(a)(4)) \$100.00 <input checked="" type="checkbox"/> and the above requirements are not met (37 C.F.R. § 1.492(a)(1)) \$710.00 <input type="checkbox"/> U.S. PTO WAS NOT INTERNATIONAL PRELIMINARY EXAMINATION AUTHORITY Where no international preliminary examination fee as set forth in § 1.482 has been paid to the U.S. PTO, and payment of an international search fee as set forth in § 1.445(a)(2) to the U.S. PTO: <input type="checkbox"/> has been paid (37 C.F.R. § 1.492(a)(2)) \$740.00 <input type="checkbox"/> has not been paid (37 C.F.R. § 1.492(a)(3)) \$1040.00 <input type="checkbox"/> where a search report on the international application has been prepared by the European Patent Office or the Japanese Patent Office (37 C.F.R. § 1.492(a)(5)) \$890.00				710.00
	Total of above Calculations				1022.00
SMALL ENTITY	Reduction by 1/2 for filing by small entity, if applicable. Assertion must be made. (note 37 C.F.R. § 1.27)				-511.00
	Subtotal				511.00
	Total National Fee				\$511.00
	Fee for recording the enclosed assignment document \$40.00 (37 C.F.R. § 1.21(h)). (See Item 13 below). See attached "ASSIGNMENT COVER SHEET".				
TOTAL	Total Fees enclosed				\$511.00

*See attached Preliminary Amendment Reducing the Number of Claims.

- ☒ Attached is a ☒ check ☐ money order in the amount of \$ 511.00
☒ Authorization is hereby made to charge the amount of \$ Additional fees as indicated below
☒ to Deposit Account No. 06-0308
☐ to Credit card as shown on the attached credit card information authorization form PTO-2038.

WARNING: Credit card information should **not** be included on this form as it may become public.

- ☒ Charge any additional fees required by this paper or credit any overpayment in the manner authorized above.

A duplicate of this paper is attached.

****WARNING:** "To avoid abandonment of the application the applicant shall furnish to the United States Patent and Trademark Office not later than the expiration of 30 months from the priority date: * * * (2) the basic national fee (see § 1.492(a)). The 30-month time limit may not be extended." 37 C.F.R. § 1.495(b).

WARNING: If the translation of the international application and/or the oath or declaration have not been submitted by the applicant within thirty (30) months from the priority date, such requirements may be met within a time period set by the Office. 37 C.F.R. § 1.495(b)(2). The payment of the surcharge set forth in § 1.492(e) is required as a condition for accepting the oath or declaration later than thirty (30) months after the priority date. The payment of the processing fee set forth in § 1.492(f) is required for acceptance of an English translation later than thirty (30) months after the priority date. Failure to comply with these requirements will result in abandonment of the application. The provisions of § 1.136 apply to the period which is set. Notice of Jan. 3, 1993, 1147 O.G. 29 to 40.

☒ **Assertion of Small Entity Status**

☒ **Applicant hereby asserts status as a small entity under 37 C.F.R. § 1.27.**

NOTE: 37 C.F.R. § 1.27(c) deals with the assertion of small entity status, whether by a written specific declaration thereof or by payment as a small entity of the basic filing fee or the fee for the entry into the national phase as states:

"(c) Assertion of small entity status. Any party (person, small business concern or nonprofit organization) should make a determination, pursuant to paragraph (f) of this section, of entitlement to be accorded small entity status based on the definitions set forth in paragraph (a) of this section, and must, in order to establish small entity status for the purpose of paying small entity fees, actually make an assertion of entitlement to small entity status, in the manner set forth in paragraphs (c)(1) or (c)(3) of this section, in the application or patent in which such small entity fees are to be paid.

(1) Assertion by writing. Small entity status may be established by a written assertion of entitlement to small entity status. A written assertion must:

(i) Be clearly identifiable;

(ii) Be signed (see paragraph (c)(2) of this section); and

(iii) Convey the concept of entitlement to small entity status, such as by stating that applicant is a small entity, or that small entity status is entitled to be asserted for the application or patent. While no specific words or wording are required to assert small entity status, the intent to assert small entity status must be clearly indicated in order to comply with the assertion requirement.

(2) Parties who can sign and file the written assertion. The written assertion can be signed by:

(i) One of the parties identified in §§ 1.33(b) (e.g., an attorney or agent registered with the Office), §§ 3.73(b) of this chapter notwithstanding, who can also file the written assertion;

(ii) At least one of the individuals identified as an inventor (even though a § 1.63 executed oath or declaration has not been submitted), notwithstanding §§ 1.33(b)(4), who can also file the written assertion pursuant to the exception under § 1.33(b) of this part; or

(iii) An assignee of an undivided part interest, notwithstanding §§ 1.33(b)(3) and 3.73(b) of this chapter, but the partial assignee cannot file the assertion without resort to a party identified under § 1.33(b) of this part.

(Transmittal Letter to the United States Elected Office (EO/US) [13-18]—page 4 of 9)

10/019117
531 Rec'd PCT/PTC 21 DEC 2001

(3) Assertion by payment of the small entity basic filing or basic national fee. The payment, by any party, of the exact amount of one of the small entity basic filing fees set forth in §§ 1.16(a), (f), (g), (h), or (k), or one of the small entity basic national fees set forth in §§ 1.492(a)(1), (a)(2), (a)(3), (a)(4), or (a)(5), will be treated as a written assertion of entitlement to small entity status even if the type of basic filing or basic national fee is inadvertently selected in error.

(i) If the Office accords small entity status based on payment of a small entity basic filing or basic national fee under paragraph (c)(3) of this section that is not applicable to that application, any balance of the small entity fee that is applicable to that application will be due along with the appropriate surcharge set forth in §§ 1.16(e), or §§ 1.16(f).

(ii) The payment of any small entity fee other than those set forth in paragraph (c)(3) of this section (whether in the exact fee amount or not) will not be treated as a written assertion of entitlement to small entity status and will not be sufficient to establish small entity status in an application or a patent."

3. ☒ A copy of the International application as filed (35 U.S.C. § 371(c)(2)):

NOTE: Section 1.495 (b) was amended to require that the basic national fee and a copy of the international application must be filed with the Office by 30 months from the priority date to avoid abandonment. "The International Bureau normally provides the copy of the international application to the Office in accordance with PCT Article 20. At the same time, the International Bureau notifies applicant of the communication to the Office. In accordance with PCT Rule 47.1, that notice shall be accepted by all designated offices as conclusive evidence that the communication has duly taken place. Thus, if the applicant desires to enter the national stage, the applicant normally need only check to be sure the notice from the International Bureau has been received and then pay the basic national fee by 30 months from the priority date." Notice of Jan. 7, 1993, 1147 O.G. 29 to 40, at 35-36. See item 14c below.

- a. ☐ is transmitted herewith.
- b. ☒ is not required, as the application was filed with the United States Receiving Office.
- c. ☐ has been transmitted
 - i. ☐ by the International Bureau.
Date of mailing of the application (from form PCT/1B/308):

 - ii. ☐ by applicant on _____. (Date)

4. ☒ A translation of the International application into the English language (35 U.S.C. § 371(c)(2)):

- a. ☐ is transmitted herewith.
- b. ☒ is not required as the application was filed in English.
- c. ☐ was previously transmitted by applicant on _____. (Date)
- d. ☐ will follow.

5. ☒ Amendments to the claims of the International application under PCT Article 19 (35 U.S.C. § 371(c)(3)):

NOTE: The Notice of January 7, 1993 points out that 37 C.F.R. § 1.495(a) was amended to clarify the existing and continuing practice that PCT Article 19 amendments must be submitted by 30 months from the priority date and this deadline may not be extended. The Notice further advises that: "The failure to do so will not result in loss of the subject matter of the PCT Article 19 amendments. Applicant may submit that subject matter in a preliminary amendment filed under section 1.121. In many cases, filing an amendment under section 1.121 is preferable since grammatical or idiomatic errors may be corrected." 1147 O.G. 29-40, at 36.

- a. ☐ are transmitted herewith.
- b. ☐ have been transmitted
 - i. ☐ by the International Bureau.
Date of mailing of the amendment (from form PCT/1B/308):

 - ii. ☐ by applicant on _____. (Date)
- c. ☒ have not been transmitted as
 - i. ☒ applicant chose not to make amendments under PCT Article 19.
Date of mailing of Search Report (from form PCT/ISA/210.):
Never Received.
 - ii. ☐ the time limit for the submission of amendments has not yet expired. The amendments or a statement that amendments have not been made will be transmitted before the expiration of the time limit under PCT Rule 46.1.

6. ☒ A translation of the amendments to the claims under PCT Article 19 (38 U.S.C. § 371(c)(3)):
- a. ☐ is transmitted herewith.
 - b. ☐ is not required as the amendments were made in the English language.
 - c. ☒ has not been transmitted for reasons indicated at point 5(c) above.

7. ☒ A copy of the international examination report (PCT/IPEA/409)
- ☐ is transmitted herewith.
 - ☒ is not required as the application was filed with the United States Receiving Office.

8. ☒ Annex(es) to the international preliminary examination report
- a. ☐ is/are transmitted herewith.
 - b. ☒ is/are not required as the application was filed with the United States Receiving Office.

9. ☐ A translation of the annexes to the international preliminary examination report
- a. ☐ is transmitted herewith.
 - b. ☐ is not required as the annexes are in the English language.

(Transmittal Letter to the United States Elected Office (EO/US) [13-18]—page 6 of 9)

10049117 631702
10/019117
531 Rec'd PCT/PTC 21 DEC 2001

10. ☒ An oath or declaration of the inventor (35 U.S.C. § 371(c)(4)) complying with 35 U.S.C. § 115
- a. ☐ was previously submitted by applicant on _____. (Date)
 - b. ☐ is submitted herewith, and such oath or declaration
 - i. ☐ is attached to the application.
 - ii. ☐ identifies the application and any amendments under PCT Article 19 that were transmitted as stated in points 3(b) or 3(c) and 5(b); and states that they were reviewed by the inventor as required by 37 C.F.R. § 1.70.
 - c. ☒ will follow.

II. Other document(s) or information included:

11. ☒ An International Search Report (PCT/ISA/210) or Declaration under PCT Article 17(2)(a):
- a. ☐ is transmitted herewith.
 - b. ☐ has been transmitted by the International Bureau.
Date of mailing (from form PCT/IB/308): _____
 - c. ☒ is not required, as the application was searched by the United States International Searching Authority.
 - d. ☐ will be transmitted promptly upon request.
 - e. ☐ has been submitted by applicant on _____. (Date)
12. ☒ An Information Disclosure Statement under 37 C.F.R. §§ 1.97 and 1.98:
- a. ☒ is transmitted herewith.

Also transmitted herewith is/are:

- ☒ Form PTO-1449 (PTO/SB/08A and 08B).
 - ☒ Copies of citations listed.
 - b. ☐ will be transmitted within THREE MONTHS of the date of submission of requirements under 35 U.S.C. § 371(c).
 - c. ☐ was previously submitted by applicant on _____. (Date)
13. ☐ An assignment document is transmitted herewith for recording.
- A separate ☐ "COVER SHEET FOR ASSIGNMENT (DOCUMENT) ACCOMPANYING NEW PATENT APPLICATION" or ☐ FORM PTO 1595 is also attached.
- _____

14. ☒ Additional documents:
- a. ☐ Copy of request (PCT/RO/101)
 - b. ☒ International Publication No. W0 01/00918
 - i. ☒ Specification, claims and drawing
 - ii. ☐ Front page only
 - c. ☐ Preliminary amendment (37 C.F.R. § 1.121)
 - d. ☐ Other

15. ☒ The above checked items are being transmitted
- a. ☒ before 30 months from any claimed priority date.
 - b. ☐ after 30 months.
16. ☐ Certain requirements under 35 U.S.C. § 371 were previously submitted by the applicant on _____, namely:

AUTHORIZATION TO CHARGE ADDITIONAL FEES

WARNING: Accurately count claims, especially multiple dependant claims, to avoid unexpected high charges if extra claims are authorized.

NOTE: "A written request may be submitted in an application that is an authorization to treat any concurrent or future reply, requiring a petition for an extension of time under this paragraph for its timely submission, as incorporating a petition for extension of time for the appropriate length of time. An authorization to charge all required fees, fees under § 1.17, or all required extension of time fees will be treated as a constructive petition for an extension of time in any concurrent or future reply requiring a petition for an extension of time under this paragraph for its timely submission. Submission of the fee set forth in § 1.17(a) will also be treated as a constructive petition for an extension of time in any concurrent reply requiring a petition for an extension of time under this paragraph for its timely submission." 37 C.F.R. § 1.136(a)(3).

NOTE: "Amounts of twenty-five dollars or less will not be returned unless specifically requested within a reasonable time, nor will the payer be notified of such amounts; amounts over twenty-five dollars may be returned by check or, if requested, by credit to a deposit account." 37 C.F.R. § 1.26(a).

- ☒ Please charge, in the manner authorized above, the following additional fees that may be required by this paper and during the entire pendency of this application:
- ☒ 37 C.F.R. § 1.492(a)(1), (2), (3), and (4) (filing fees)

WARNING: Because failure to pay the national fee within 30 months without extension (37 C.F.R. § 1.495(b)(2)) results in abandonment of the application, it would be best to always check the above box.

(Transmittal Letter to the United States Elected Office (EO/US) [13-18]—page 8 of 9)

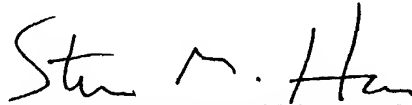
10/019117
531 Rec'd PCT 21 DEC 2001☒ 37 C.F.R. § 1.492(b), (c) and (d) (presentation of extra claims)

NOTE: Because additional fees for excess or multiple dependent claims not paid on filing or on later presentation must only be paid or these claims cancelled by amendment prior to the expiration of the time period set for response by the PTO in any notice of fee deficiency (37 C.F.R. § 1.492(d)), it might be best not to authorize the PTO to charge additional claim fees, except possible when dealing with amendments after final action.

☒ 37 C.F.R. § 1.17 (application processing fees)☒ 37 C.F.R. § 1.17(a)(1)–(5) (extension fees pursuant to § 1.136(a).☐ 37 C.F.R. § 1.18 (issue fee at or before mailing of Notice of Allowance, pursuant to 37 C.F.R. § 1.311(b))

NOTE: Where an authorization to charge the issue fee to a deposit account has been filed before the mailing of a Notice of Allowance, the issue fee will be automatically charged to the deposit account at the time of mailing the notice of allowance. 37 C.F.R. § 1.311(b).

NOTE: 37 C.F.R. § 1.28(b) requires "Notification of any change in loss of entitlement to small entity status must be filed in the application . . . prior to paying, or at the time of paying . . . issue fee." From the wording of 37 C.F.R. § 1.28(b): (a) notification of change of status must be made even if the fee is paid as "other than a small entity" and (b) no notification is required if the change is to another small entity.

☒ 37 C.F.R. § 1.492(e) and (f) (surcharge fees for filing the declaration and/or filing an English translation of an International Application later than 30 months after the priority date).

SIGNATURE OF PRACTITIONER

Reg. No.: 37,841

Steven M. Haas

Tel. No.: (216) 861-5582

(type or print name of practitioner)

1100 Superior Avenue, Seventh Floor

Customer No.:

P.O. Address

Cleveland, Ohio 44114

HEMMING APPARATUS AND METHOD

This application claims the benefit of and hereby expressly incorporates by reference U.S. Provisional Application Serial No. 60/141,434, filed on June 29, 1999.

Background of the Invention

5 Field of the Invention

The present invention relates to the hemming arts. More particularly, the present invention relates to improvements in a hemming apparatus and an improved method for hemming sheet metal or like material together. The present invention finds particular application in the automotive field and will be described with particular reference thereto. However, it is to be appreciated that the present invention is also amenable to other like applications.

15 Discussion of the Art

In the automotive field it is often desirable to join two pieces of sheet metal together in a hemming operation to form a door, hood, trunk deck, or other such component. Generally, a unitary outer skin of sheet metal is hemmed to a second inner reinforcing panel of sheet metal. Hemming involves bending and compressing a generally upturned or perpendicular flange located along each edge of the outer sheet over an adjacent edge of the inner panel. It is important that the hemming results in a firm, vise-like grip of the flanges of the inner panel between the outer panel and its marginal flanges and that

the shape and dimensions of the overall assembly are held within prescribed tolerances.

In the prior art, such hemming has often been accomplished in two separate stages often using two sets of dies mounted in two successive presses. The inner reinforcing panel is nested within the unitary outer panel which is fixtured on an anvil die on a base of a prehemming machine. Upon fixturing the assembly, a tool of the machine, commonly referred to as a hemming steel, engages and bends an edge of the outer panel to an acute included angle with respect to the outer panel. Prehemming is sometimes referred to as "fortyfive-ing" because the angle of the flange becomes about forty-five degrees with respect to the general plane of the outer panel. After prehemming all edges to be joined, both panels are released, transferred to, and fixtured in a second hemming machine where a second steel completely bends the prehemmed edge of the outer panel over the peripheral edge of the reinforcing panel to secure and attach the panels together as a unitary structural member for assembly on a vehicle. This second stage is often referred to as full-hemming.

An obvious disadvantage of the two-stage, two-machine system is the need for two machines which require a significant amount of floor space as well as time and labor resources required for moving the assembly out of one press and into the second press. Because of these disadvantages, the two-stage, two-press system was improved upon and eventually evolved into a single station, two press system where prehemming and full-hemming occur without the need for re-fixturing the assembly between stages. Typically, a plurality of both prehemming and final hemming machines were respectively grouped around the periphery of a panel to perform all prehemming and full-

WO 01/00918

PCT/US00/17933

hemming operations for one assembly either sequentially or substantially simultaneously.

After further improvements, hemming machines were designed to perform both the prehem and final hem operation in a single station, single machine system. Hemming machines of this type vary in the kind of mechanism used and the manner of carrying out the hemming operations.

One group includes machines having linkage driven steels, machines having one rotary steel driven by another linear driven steel, and machines having one steel telescopingly hem from within the prehemming steel. Representative of this group are the following patents: U.S. Patent No. 1,693,643 to D'Ardenne, U.S. Patent No. 5,404,742 to Wilson et al, and U.S. Patent No. 3,903,934 to Vizy.

Another group includes machines having steels that traverse generally linearly in one or two directions. hemming machines of this type, such as U.S. Patent No. 3,143,095 to Tribe, may have a prehemming steel traversing across the general plane of the outer skin and a full-hemming steel traveling perpendicular to the plane of the outer skin. The obvious disadvantage of this type of machine is that it requires two steels or dies, two directions of travel, extra cycle time for two operations, and a substantial amount of space around the assembly which prevents the hemming of internal edges. Alternatively, machines, such as U.S. Patent No. 5,315,855 to Jackson, use a single steel traversing in only the plane of the outer skin have been disclosed but still require a substantial amount of space preventing internal hemming and often result in a hem that is not firm, out of tolerance, and of low visual quality. Finally, there are machines, such as U.S. Patent No. 1,961,582 to Eksergian, that travel only

perpendicular to the general plane of the outer skin but still require substantial space around the assembly, two steels, and do not create a quality hem.

Therefore, it is desirable to provide an improved
5 apparatus and method for hemming sheet material together. The present invention contemplates such an invention that overcomes many of the problems of the prior art and others.

Brief Summary of the Invention

In accordance with the present invention, an
10 improved apparatus and method for prehemming and hemming is provided for minimizing the above-referenced and other disadvantages of the prior art, and in particular, for folding an edge portion of a curved arcuate panel to create a hem in a single cycle of operation with a single hemming
15 swing steel pressed only in the vertical direction.

In accordance with one aspect of the present invention, a hemming apparatus for hemming an outer skin and inner panel together is provided. The apparatus includes an anvil for supporting an associated assembly.
20 The assembly comprising the outer skin and the inner panel. The apparatus additionally includes an upper body and a steel mounted to the upper body. The steel is adapted for movement between first and second operative positions. Furthermore, the steel has a first angled surface for
25 prehemming the assembly when the steel is in the first operative position and a second angled surface for full-hemming the assembly when the steel is in the second operative position.

In accordance with another aspect of the present
30 invention, a method for hemming an outer skin and inner panel together is provided. It includes placing an

assembly on a supporting surface of an anvil. The assembly comprising an inner panel positioned on an outer skin where the inner panel has a peripheral edge and the outer skin has a peripheral flange. It next includes moving a hemming steel, while in a first operative position, in a first direction into the peripheral flange of the outer skin so that an angled prehemming surface of the steel deforms the flange toward the inner panel thereby prehemming the assembly. The hemming steel is further moved in the first direction moving the hemming steel into a second operative position. Meanwhile, the steel moves into the deformed peripheral flange so that a hemming surface of the steel engages the deformed flange and moves it into close contact with the inner panel thereby full-hemming the assembly. Finally, the steel is moved away from the hemmed assembly and removing the finished assembly from the supporting surface.

One advantage of the present invention is the provision of a hemming apparatus that requires only one steel reducing the construction costs of the machine and the maintenance costs of the steel.

Another advantage of the present invention is the provision of a hemming apparatus that substantially reduces the risk of the die "smashing" because the machine will only use one steel to contact the peripheral edge of the assembly.

Another advantage of the present invention is the provision of a hemming apparatus that lacks many complex and moving components.

Another advantage of the present invention is the provision of a hemming apparatus that uses only vertical press motion which prevents compression of the outer, and more visual, skin. Preventing such compression eliminates

or reduces unsightly buckling or waves caused by overruns on the inner skin.

Another advantage of the present invention is the provision of a hemming apparatus that only requires a vertical, mechanical press for operation.

Another advantage of the present invention is the provision of a hemming apparatus that requires only one stroke of a mechanical press to produce a complete hem.

Another advantage of the present invention is the provision of a hemming apparatus that may be used in places such as window openings, gas cap openings, and the like.

Another advantage of the present invention is the provision of a hemming apparatus that substantially reduces the number of weld spots typically required for an entire assembly.

Still further advantages and benefits of the present invention will become apparent to those of ordinary skill in the art upon reading and understanding the following detailed description.

Brief Description of the Drawings

The structure, operation and advantages of the presently preferred embodiment of this invention will become further apparent upon consideration of the following description, taken in conjunction with the accompanying drawings. Of course, the drawings are only for purposes of illustrating preferred embodiments and are not to be construed as limiting the invention.

FIG. 1a is a cross-sectional view of two sheets prior to prehemming and full-hemming in accordance with aspects of the present invention;

FIG. 1b is a cross-sectional view of the two sheets depicted in FIG. 1a after prehemming and before

full-hemming in accordance with aspects of the present invention;

FIG. 1c is a cross-sectional view of the two sheets depicted in FIG. 1a after prehemming and full-hemming in accordance with aspects of the present invention;

FIG. 2 is a diagrammatic view showing a preferred embodiment of a hemming apparatus in accordance with aspects of the present invention;

FIG. 3 is a diagrammatic side view of a prior art two-steel, two-directional hemming apparatus and its related compression forces;

FIG. 4 is a diagrammatic view of the hemming apparatus shown in FIG. 2 and its related compression forces in accordance with aspects of the present invention;

FIG. 5 is a diagrammatic view of an alternate embodiment of a steel in accordance with aspects of the present invention;

FIG. 6a is a diagrammatic view showing an alternate preferred embodiment of a hemming apparatus in accordance with aspects of the present invention;

FIG. 6b is a diagrammatic view of the hemming apparatus shown in FIG. 6a showing the steel in a first position prehemming an assembly; and

FIG. 6c is a diagrammatic view of the hemming apparatus shown in FIG. 6a showing the steel in a second position full-hemming the assembly.

Detailed Description of the Invention

Referring now to the drawings wherein like reference characters represent like elements, the showings

are for purposes of illustrating preferred embodiments of the invention only and not for purposes of limiting the same. The improved hemming apparatus and method described in the description below accurately and speedily carries
5 out an entire prehemming and clinching/full-hemming operation in one cycle and supplies firmly clinched flanges without affecting the dimensional accuracy or the visual appearance of the finished product.

With reference to FIGS. 1a-1c, an assembly is
10 generally indicated by reference numeral 10. The assembly 10 includes two elements of pressed sheet metal or other suitable material respectively constituting the unitary outer skin 12 and the inner reinforcing panel 14 of a motor vehicle assembly. The assembly 10 may be, without
15 limitation, a motor vehicle door, hood, trunk deck or other component. The assembly 10 rests on a fixed supporting structure or anvil 16. The anvil 16 has a horizontal supporting surface 18 for positioning and supporting the outer skin 12 and the inner panel 14.

20 FIGS. 1a-1c depict the sequential movement and resulting position of the assembly 10 during a hemming operation. With specific reference to FIG. 1a, the outer skin 12 and the inner panel 14 are shown at rest prior to the hemming operation. The underlying outer skin 12 has a
25 peripheral flange 12a arranged substantially at ninety degrees with respect to the anvil supporting surface 18 and is offset slightly from distal end of the peripheral edge 14a of the overlying inner panel 14 as is well known.

With specific reference to FIG. 1b, the outer
30 skin 12 and the inner panel 14 are shown after the first step or prehemming step of the hemming operation. In this step, the peripheral flange 12a of the outer skin 12 is

bent forty-five degrees relative to its starting position in the direction of the inner panel 14.

With specific reference to FIG. 1c, the outer skin 12 and the inner panel 14 are shown after the clinching or full-hemming step. In this step, the peripheral flange 12a of the outer skin 12 is bent further and now is arranged at about ninety degrees relative to its initial position. The peripheral flange 12a is superimposed and pressed against the peripheral edge 14a creating a joint between the outer skin 12 and the inner panel 14. Many such joints may exist on a single assembly 10 and are generally located about the periphery edges of the outer skin 12 and the inner panel 14. Joints may even be located at interior locations on the assembly 10 such as a window or gas cap recess.

With reference to FIG. 2, a hemming apparatus 15 includes a lower body or anvil 20 having a major supporting surface 22 for supporting the unitary outer skin 12 and the inner reinforcing panel 14. The inner panel 14 is positioned on the outer skin 12 with its edge 14a slightly offset from the peripheral flange 12a. The flange 12a is arranged substantially at ninety degrees with respect to the anvil supporting surface 22. The peripheral flange 12a on the outer skin 12 rests directly along one edge 24 of the anvil 20. The same edge 24 of the anvil 20 is adjacent to a sloping side 26, angled at forty-five degrees in the preferred embodiment of the invention.

The hemming apparatus 15 additionally includes an upper body 27 as either a connected or separate component. The upper body 27 is mounted to a vertical press (not shown) as is well known. The upper body 27 holds the swing

tool or steel 28 formed in accordance with the present invention by means of a screw 30 or the like. Steel 28 is constructed of a suitable material with an appropriate hardness as is well known. The steel 28 has a round or rounded upper surface 32 which nestles inside a curved recess 34 of the upper body 27 such that the steel 28 may pivot outward from the upper body 27. An inner side 36 of the steel 28 rests against the keeper or extended portion 38 of the upper body 27. The outer or exposed side 40 is open and held in place by a spring 42 or other biasing means. The spring 42 is a blue medium duty die spring with a strength of 216 lbs. in the preferred embodiment. Of course, other suitable springs may be used.

The bottom surface of the steel 28 has two angled surfaces 50 and 52 defined at angles α and β , respectively. Angles α and β are relative to respective planes positioned parallel to the supporting surface 22. The prehemming angled surface 52, extends from the bottom open edge 44 of the steel 28 inward and upward to the approximate center 46 of the steel 28 at an angle α which is equal to that of the sloped side 26 of the anvil 20. Full-hemming angled surface 50 extends from the closed, bottom edge 48 of the steel 28 inward and downward at angle β to the approximate center 46 of the steel 28 meeting prehemming angled surface 52. The magnitude of angle β is such that when the steel 28 is forced vertically downward to its farthest position at which point the steel 28 is pivoting against the spring 42, angled surface 50 will rest parallel to the supporting surface 22 of the anvil 20.

In operation, the upper body 27 moves the steel 28 downward in a first operative position to contact the

peripheral flange 12a of the outer skin 12 and the sloping side 26 of the anvil 20. The upper body 27 is powered by a vertical press as is well known but other suitable driving means may be employed. When the steel 28 first
5 contacts the peripheral flange 12a, the flange 12a will bend inward toward the inner panel 14 until the prehemming angled surface 52 of the steel 28 contacts the sloping side 26 of the anvil 20. At this point, the steel is still in the first operative position and the bend in the peripheral
10 flange 12a is at angle α relative to the supporting surface 22 of the anvil 20. Thus, the prehemming of the peripheral flange 12a to the inner panel 14 is complete.

As the upper body 27 continues to move the steel 28 downward, i.e., toward the anvil support surface 22 and
15 a second operative position, the steel 28 is forced to pivot from the upper body 27 at the screw 30 against the force of the spring 42 owing to the prehemming surface 52 of the steel 28 slidably engaging the sloping side 26 of the anvil 20. The stiffness of the spring 42 is such that
20 steel 28 is generally secured against upper body 27, including during the prehemming operation, but gives appropriately when the steel 28 is forced to pivot against sloping side 26 of the anvil 20. The steel 28 will continue pivoting and moving downward until the full-
25 hemming angled surface 50 is substantially parallel to the supporting surface 22 of the anvil 20. At this point, the steel is in the second operative position and the peripheral flange 12a of the outer panel 12 and the inner panel 14 are completely hemmed.

30 In a preferred embodiment, the peripheral flange 12a will be arranged at about ninety degrees with respect

resistance of anvil 20, this force causes either the outer skin 12 or the inner panel 14 to buckle producing an undesirable and rough finish. The vertical steel 56 completes the hem by full-hemming the peripheral flange 12a to the peripheral edge 14a but the unsightly buckle remains in the outer skin 12 or the inner panel 14.

Referring to FIG. 4, the present invention uses only vertical motion to complete the hemming operation in contrast to the prior art. The upper body 27 moves the steel 28 downward toward the peripheral flange 12a. When the tool 28 engages the peripheral flange 12a and begins bending the peripheral flange 12a inward and downward toward the supporting surface 22 of the anvil 20, the force C applied to the peripheral flange 12a is substantially downward. The buckling problem of the prior art is absent because the peripheral flange 12a is allowed to move out toward the slope side 26 of the anvil 20. Thus, the finished hem has a desirable finish without any unsightly buckles.

Optionally, an adhesive may be applied to the peripheral flange 12a of the outer skin 12 and to the peripheral edge 14a of the inner panel 14 prior to hemming to enhance the integrity of the hem. The adhesive seals and firms the hem and enhances some or all of the advantages of the present invention.

Alternately, with additional reference to FIG. 5, the steel 28 may include an indented radius 60 located along the intersecting edge between the full-hemming angled surface 50 and prehemming angled surface 52. The radius 60 provides clearance between the steel 28 and the assembly 10 during the movement of the steel 28 from the first operative position where prehemming occurs and the second

operative position where full-hemming occurs. Such clearance decreases the likelihood of the steel 28 damaging the peripheral flange 12a and edge 14a during the transition between the two positions.

5 With reference to FIGS. 6a-6c, a hemming apparatus 100 is shown according to an alternate preferred embodiment of the present invention. The apparatus 100 includes an anvil 20 having a major supporting surface 22 for supporting the unitary outer skin 12 and the inner
10 reinforcing panel 14. The supporting surface 22 is angled approximately twelve degrees relative to the vertical face 102 of the anvil 20. The outer skin 12 rests on the supporting surface 22 with the inner panel 14 positioned on the outer skin 12. The outer skin 12 includes a peripheral
15 flange 12a which extends away from and perpendicular to the supporting surface 22. The peripheral flange 12a is positioned at or near one edge 24 of the anvil 20. Adjacent the supporting surface 22 is a sloping side 26 which extends at a forty-five degree angle relative to the
20 supporting surface 22.

The hemming apparatus 100 includes an upper body 27. The upper body 27 is mounted to vertical press by means of a die shoe and a machine steel sub plate as is well known. The upper body 27 holds a steel 28 formed in
25 accordance with the present invention. The steel 28 has a rounded upper surface 32 which nestles inside a curved recess 34 of the upper body 27. An inner side 36 of the steel 28 rests against an extended portion 38 of the upper body 27.

30 The apparatus 100 additionally includes a spring housing 104 that encloses a medium or heavy duty die spring

WO 01/00918

PCT/US00/17933

42. The housing 104 is adapted to receive a preload spacer 106 at a distal end of the spring 42 and includes a spring cap 108 for forcing the spring 42 against the steel 28. The preload spacer 106 may vary and serves the purpose of
 5 allowing for variable adjustment of the resistance of the spring 42. A plurality of roller bearings 110 are also provided and secured to the steel 28 by a connecting means 111. Roller bearings 110 engage a cam 114 mounted to the anvil 20 upon actuation and movement of the vertical press
 10 toward the anvil 20 so that roller bearings 110 travel on the cam 114 and move the steel 28 into its second operative position. The steel 28 is shown in a first position prior to actuation and movement by the vertical press.

Similar to the first preferred embodiment, the
 15 steel 28 has two angled surfaces, a prehemming surface 52 and a full-hemming surface 50. The respective angles of the surfaces 50 and 52 are calculated as described above. The prehemming surface 52 is at an angle approximately equal to that of the sloping side 26 and the hemming
 20 surface 50 is at an angle adapted to provide a full hem upon pivotal movement of the steel 28.

In operation, the upper body 27, powered by the vertical press, moves the steel 28 toward the peripheral flange 12a of the outer skin 12. The steel 28 is initially
 25 in a first or resting position, i.e., the steel 28 is urged against the extended portion 38 by the spring 42. The steel 28 will contact and bend the peripheral flange 12a inward toward the inner panel 14 until the roller bearings 110 engage the cam 114. With reference to FIG. 6b, the
 30 bend in the peripheral flange 12a is at an angle approximately equal to the sloping side 26 of the anvil 20

and the roller bearings 110 are fully engaged with the cam 114. Thus, the prehemming of the peripheral flange 12a is complete. At this point, the engagement between the roller bearings 110 and the cam 114 prevent the prehemming surface 52 of the steel 28 from moving any further into the peripheral flange.

Further movement by the vertical press forces the steel 28 to pivot against the spring 42. The roller bearings 110 move along the cam 114 and the steel 28 pivots from a first position to a second position. During the transition from the first position to the second position, the full-hemming surface 50 of the steel 28 engages and moves the peripheral flange 12a of the outer skin 12. The full-hemming surface 50 continues to bend the peripheral flange 12a toward the inner panel 14 until the flange 12a is superimposed and pressed against the peripheral edge 14a of the inner panel 14. At this point the steel 28 is in its second operative position and the assembly is fully hemmed (FIG. 6c). As in a previous embodiment, the vertical press may be reversed to remove the steel 28 from the hemmed assembly 10 and the hemmed assembly 10 may be removed.

The invention has been described with reference to the preferred embodiments. Obviously, modifications and alterations will occur to others upon reading and understanding the preceding detailed description. It is intended that the invention be construed as including all such modifications and alterations insofar as they come within the scope of the appended claims or the equivalents thereof.

the first operative position to the second operative position when the steel is moved adjacent the anvil.

6. The apparatus of claim 1 wherein the steel is mounted within a curved recess of the upper body and held against an extended portion of the upper body when the steel is in the first operative position.

7. The apparatus of claim 1 further comprising:
a bias means for urging the steel to the first operative position.

8. The apparatus of claim 7 wherein the bias means is a spring.

9. The apparatus of claim 1 wherein the steel includes an indented radius along an intersecting edge of the first and second angled surfaces, the radius providing clearance between the steel and the assembly when the steel transitions from the first to the second operative position.

10. The apparatus of claim 1 wherein an adhesive is applied between the outer skin and the inner panel for enhancing the integrity of the hem.

11. A hemming apparatus for hemming panels together, the apparatus comprising:

an anvil including a support surface adapted for supporting an assembly that includes first and second adjacent panels to be hemmed, the first panel including a peripheral flange projecting away from the anvil support surface and the second panel including a peripheral edge

place adjacent the flange;

an upper body, at least one of said anvil and said upper body movable toward the other;

a hemming steel connected to the upper body and adapted for movement between first and second operative positions, the hemming steel defining a prehemming surface and a hemming surface angled at respective first and second angles relative to the anvil support surface whereby, upon movement of the upper body and the anvil together, the prehemming steel surface contacts and deforms the flange, and upon continued movement of the upper body and anvil together the steel moves to the second operative position so that the second, full-hemming surface engages the deformed flange and moves the deformed flange into close abutment with the second panel.

12. The apparatus of claim 11 further comprising:

a bias means for urging the steel to the first operative position.

13. The apparatus of claim 12 wherein the bias means is a spring.

14. The apparatus of claim 11 wherein the anvil includes a sloped surface adjacent the support surface for contacting and moving the steel from the first operative position to the second operative position when the anvil and the upper body move together.

15. The apparatus of claim 11 wherein the steel is pivotally connected to the upper body and adapted to pivot between the first and second operative positions:

16. The apparatus of claim 15 wherein the steel is forced to pivot from the first position to the second position when the steel engages the sloped surface of the anvil.

17. The apparatus of claim 11 wherein an adhesive is applied between the peripheral flange and the peripheral edge prior to full-hemming.

18. A method for hemming an outer skin and inner panel together, the method comprising the steps of:

placing an assembly on a supporting surface of an anvil, the assembly comprising an inner panel positioned on an outer skin, the inner panel having a peripheral edge and the outer skin having a peripheral flange;

moving a hemming steel, while in a first operative position, in a first direction into the peripheral flange of the outer skin so that an angled prehemming surface of the steel deforms the flange toward the inner panel thereby prehemming the assembly;

moving the hemming steel to a second operative position and moving the hemming steel further in the first direction into the deformed peripheral flange so that a hemming surface of the steel engages the deformed flange and moves it into close contact with the inner panel thereby full-hemming the assembly.

moving the steel away from the hemmed assembly;
and

removing the finished assembly from the supporting surface.

19. The method of claim 18 wherein the peripheral flange of the outer panel is upstanding and the

peripheral edge of the inner panel is flat, both relative to the supporting surface and prior to any contact by the steel.

20. The method of claim 18 wherein the anvil includes a sloped surface for engaging the steel and causing the steel to move from the first operative position to the second operative position when the steel is moved in the first direction after prehemming.

21. The method of claim 18 further comprising:
applying an adhesive to at least one of the inner panel and the outer skin the region of the peripheral edge and the peripheral flange, respectively.

22. The method of claim 20 wherein the prehemming occurs substantially simultaneously with the steel engaging the sloped side of the anvil.

23. The method of claim 18 wherein movement of the steel from the first operative position to a second operative position is completed during a single stroke of the steel in the first direction.

24. The method of claim 23 wherein the single stroke is continuous and uninterrupted.

25. A hemming method comprising:
providing a first sheet metal panel including a first surface and an upturned flange that projects outwardly away from the first surface;
placing a second surface of a second sheet metal panel in abutment with the first surface, with an edge of

the prehemming location to the full-hemming location when the hemming tool contacts and engages at least one of the support surface and a fixed member adjacent the support surface.

28. A method for hemming an outer skin and inner panel of a motor vehicle assembly together, the method comprising the steps of:

placing an assembly on a supporting surface of an anvil, the assembly comprising an inner panel positioned on the an outer skin, the inner panel having a peripheral edge and the outer skin having a peripheral flange;

moving a steel in a single stroke into the peripheral flange of the outer skin and the peripheral edge of the inner panel thereby hemming the assembly, the steel having a first angled surface for effecting a prehem and a second angled surface for effecting a full-hem, wherein the steel moves from a first prehem position to a second full-hem position during the single stroke to align the first and second angled surfaces with the assembly sequentially;

removing the steel from the hemmed assembly; and

removing the finished assembly from the supporting surface.

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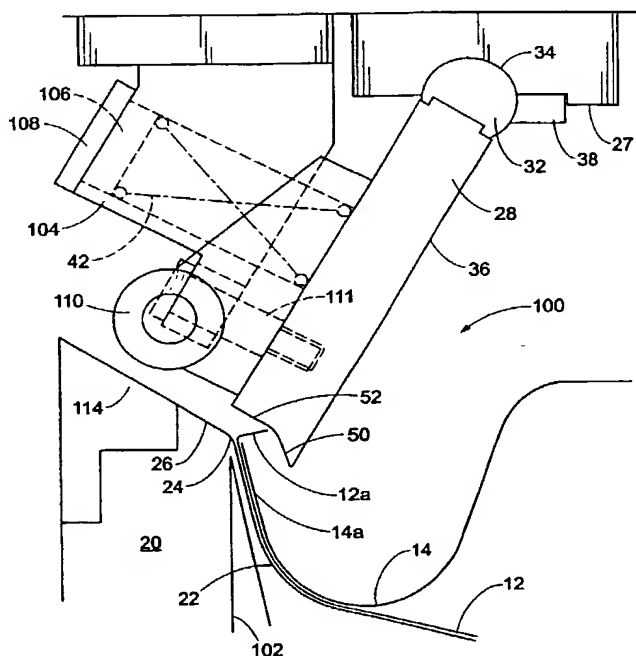
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(54) Title: **HEMMING APPARATUS AND METHOD**



(57) **Abstract:** In accordance with the present invention, an improved apparatus and method for prehemming and hemming is provided. More particularly, the improved apparatus and method is for folding an edge portion of a curved arcuate panel to create a hem in a single cycle of operation with a single hemming swing steel pressed only in the vertical direction. The apparatus and method use an anvil for supporting an associated assembly of the outer skin and the inner panel, an upper body, and a steel mounted to the upper

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WO 01/00918 A2

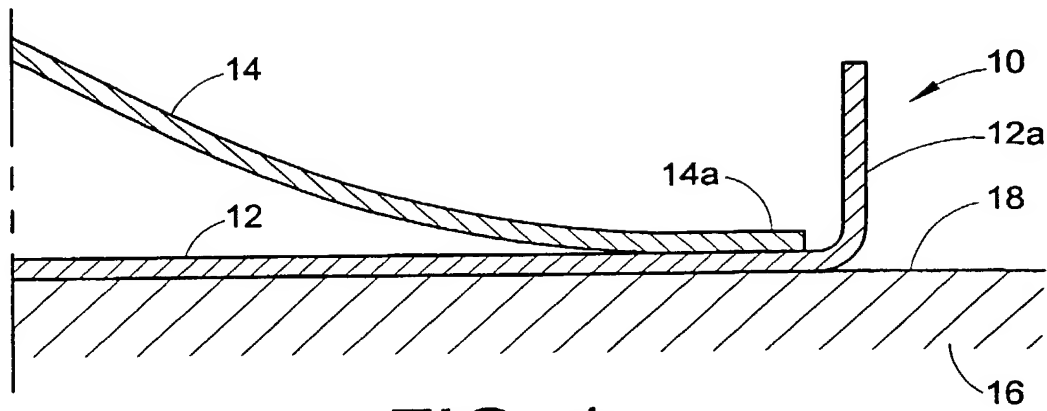


FIG. 1a

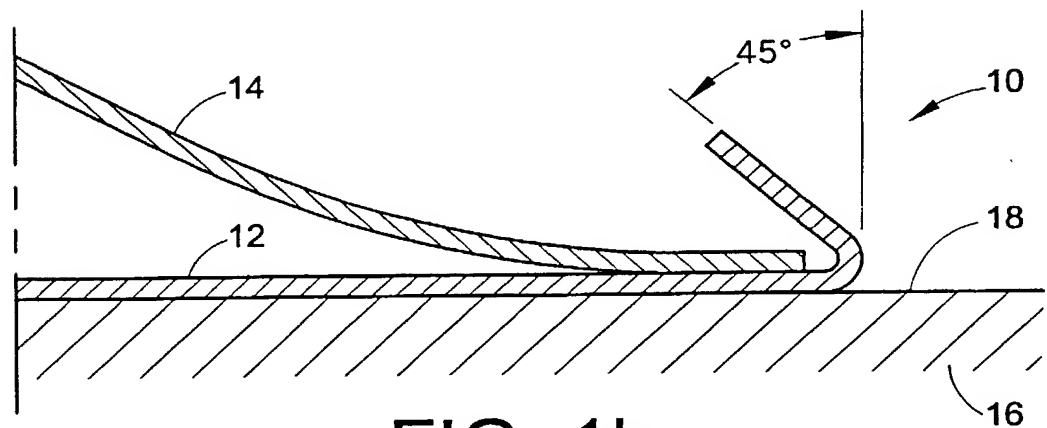


FIG. 1b

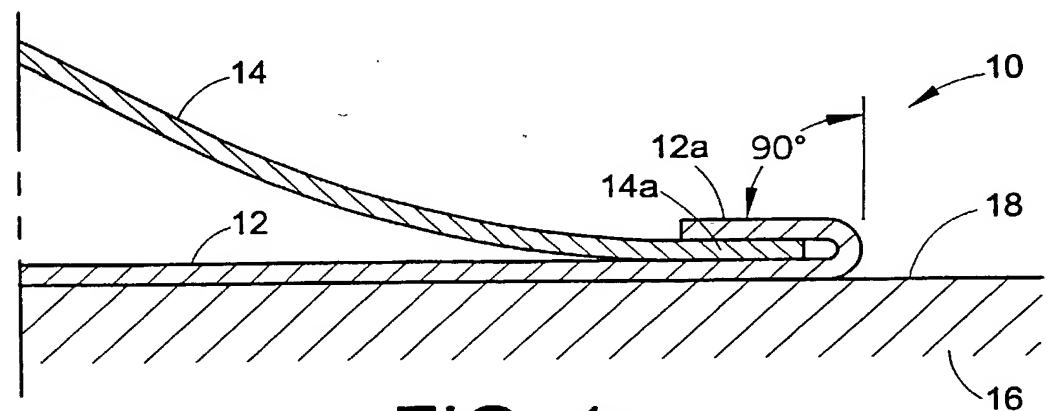
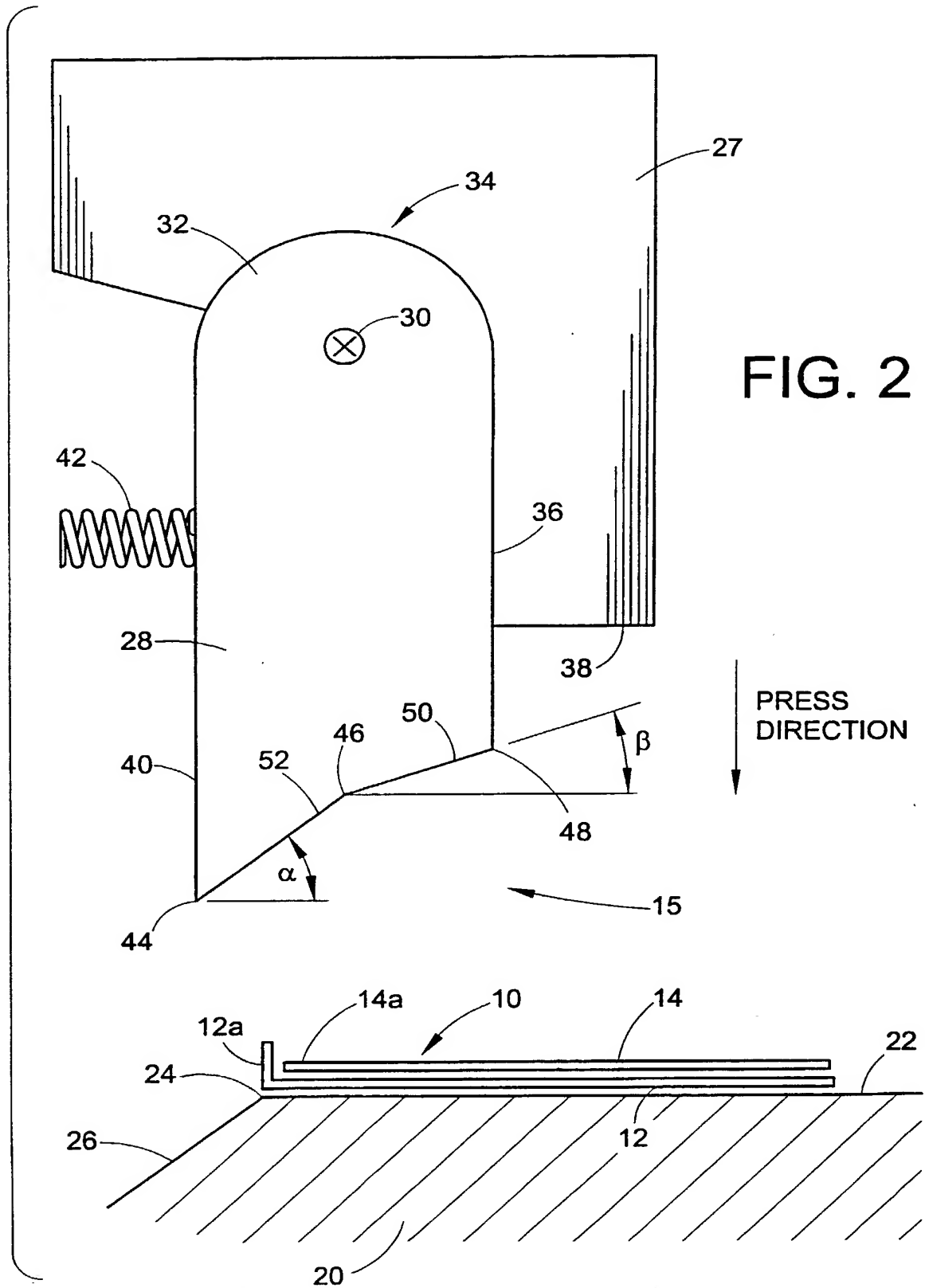


FIG. 1c



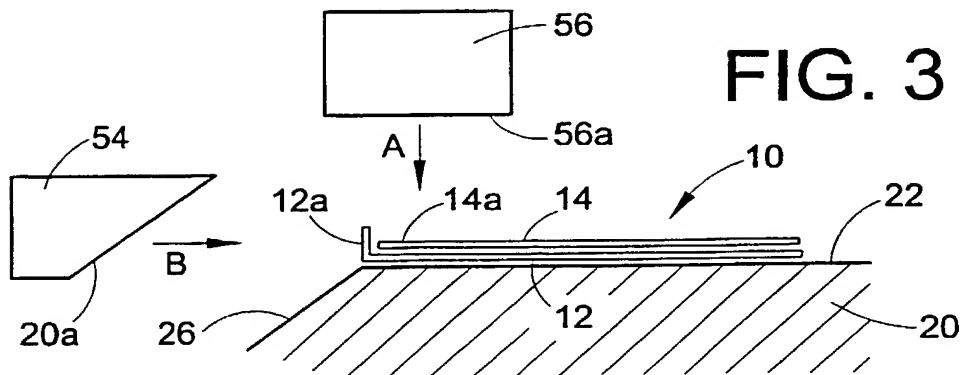


FIG. 4

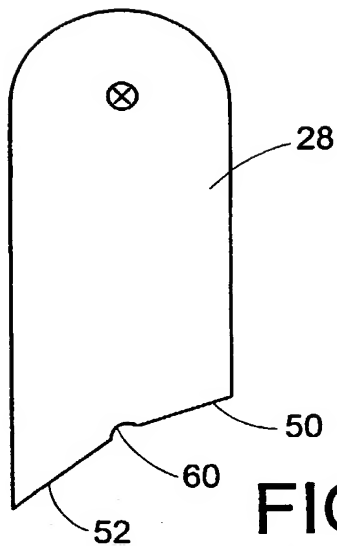
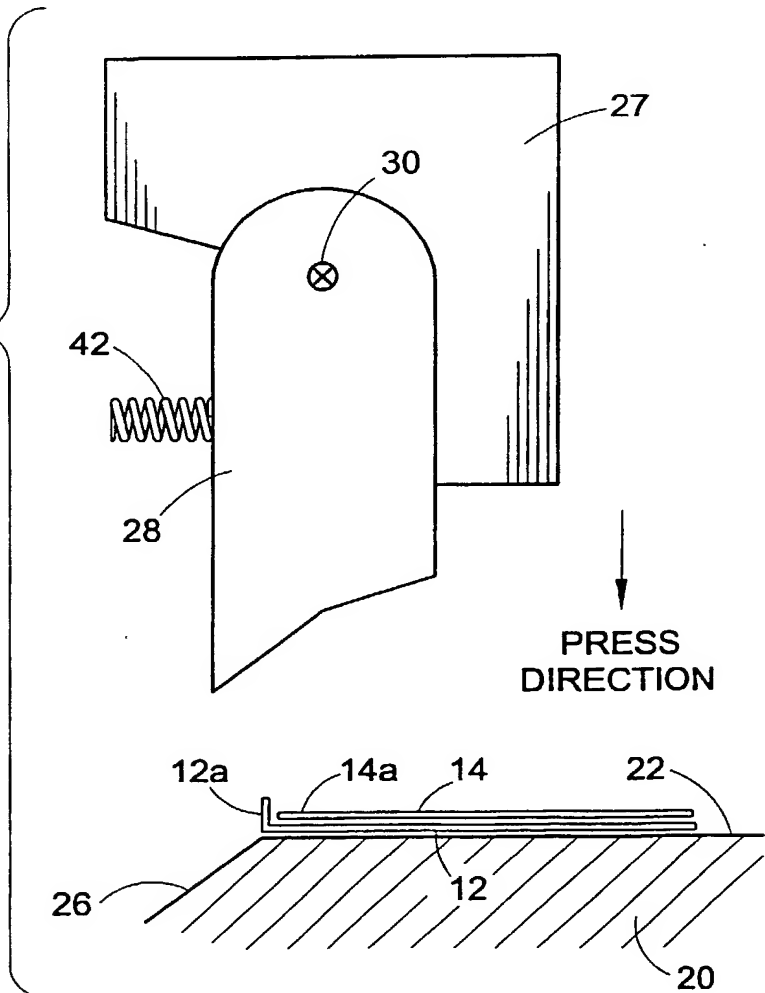


FIG. 5

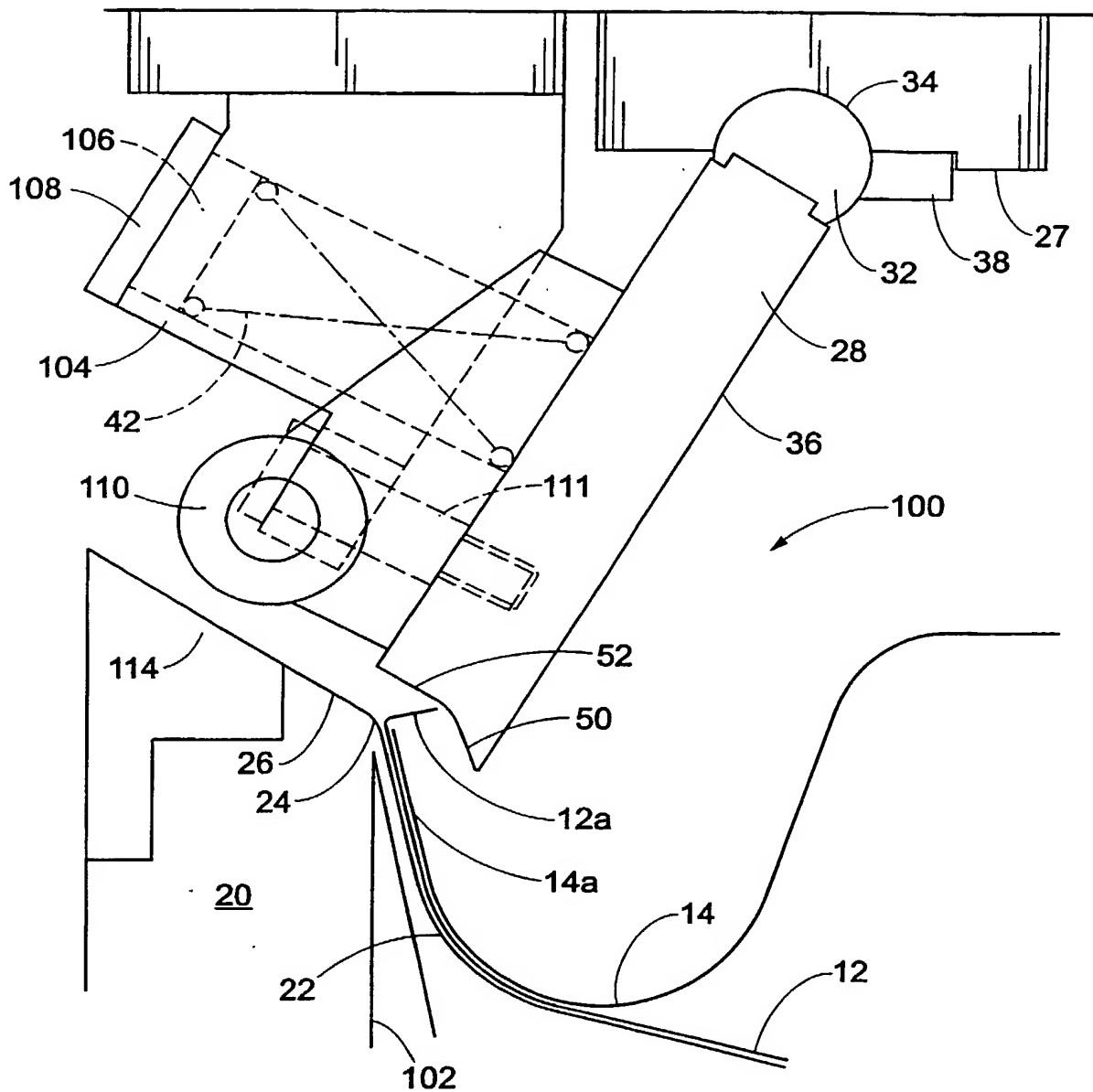


FIG. 6a

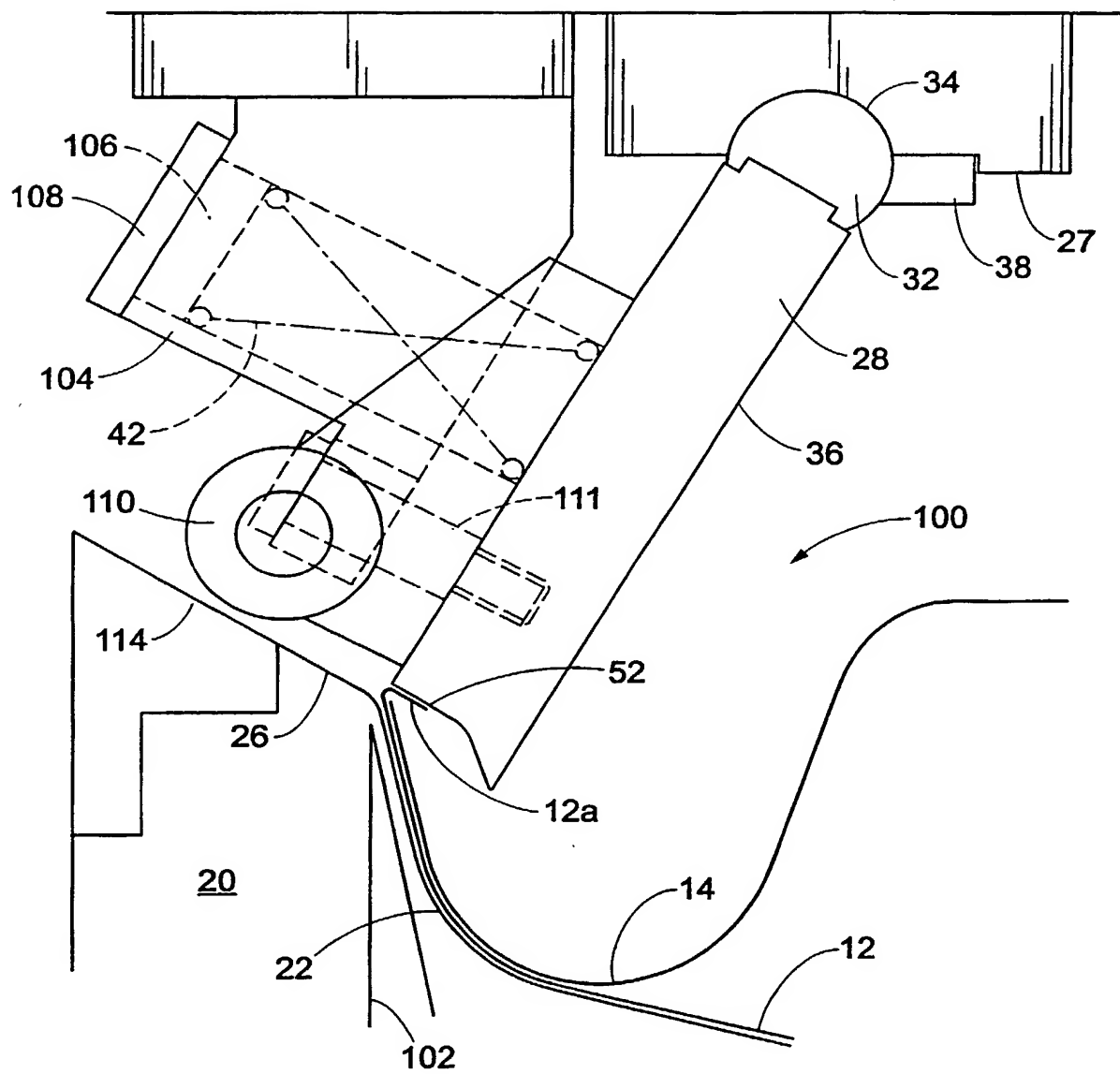


FIG. 6b

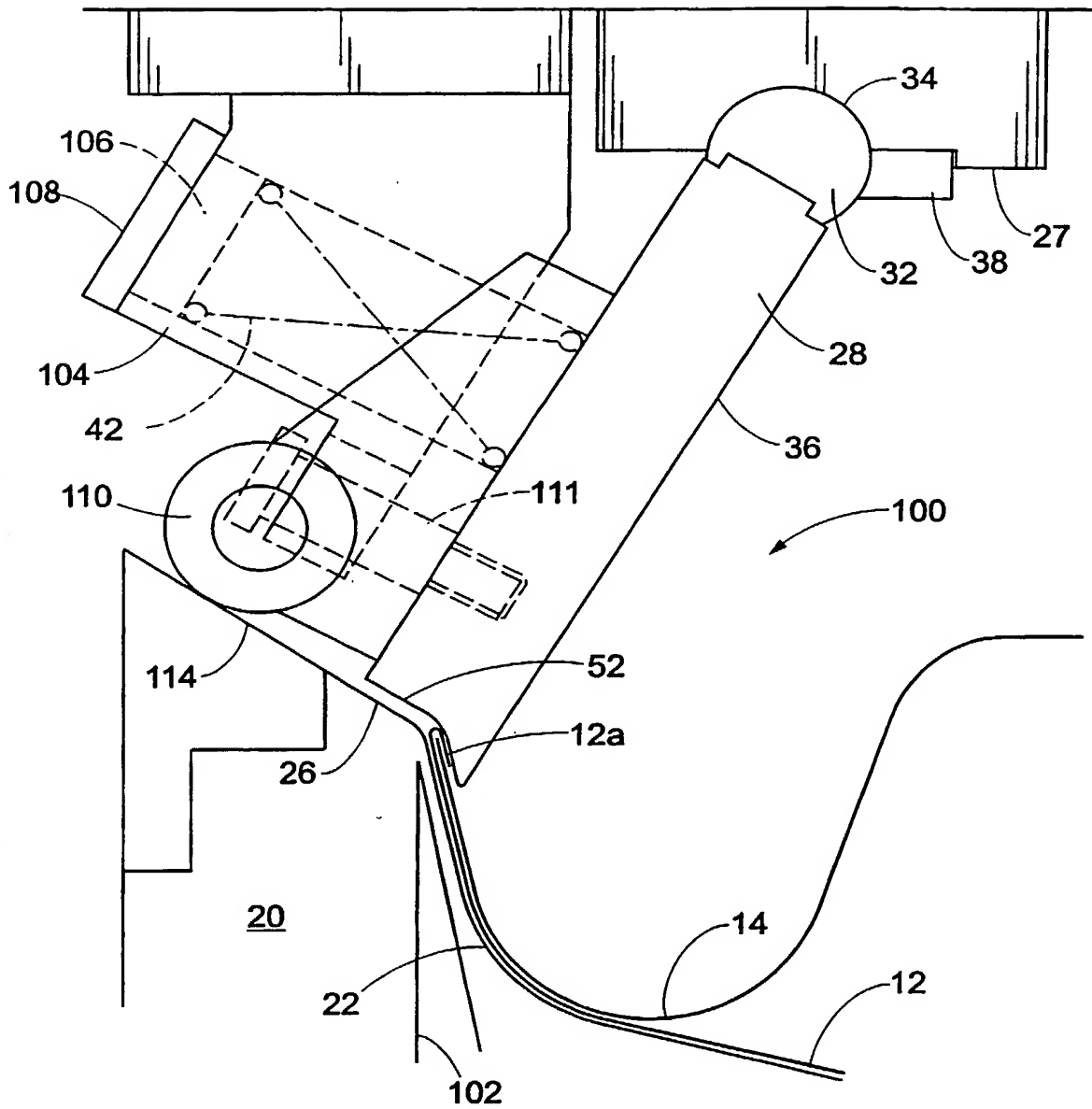


FIG. 6c

DECLARATION AND POWER OF ATTORNEY FOR UTILITY PATENT APPLICATION

(37 CFR 1.63)

As a below inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled:

HEMMING APPARATUS AND METHOD

the specification of which

☐ is attached hereto or

☒ was filed on December 21, 2001 as United States Application Number 10/019,117

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCT international filing date of the continuation-in-part application.

I hereby claim foreign priority benefits under 35 U.S.C. § 119(a)-(d) or (f), or 365(b) of any foreign application(s) for patent or inventor's certificate(s), or 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application(s) for patent or inventor's certificate(s), or any PCT international application having a filing date before that of the application on which priority is claimed:

Prior Foreign Application Number(s)	Country	Foreign Filing Date	Priority Not Claimed	Certified Copy Attached?	
				YES	NO
				<input type="checkbox"/>	<input type="checkbox"/>

I hereby claim the benefit under 35 U.S.C. 119(e) of an United States provisional application(s) listed below.

Application Number(s)	Day/Month/Year Filed	Additional Provisional Application Numbers Listed on Supplemental Priority Data Sheet Attached
60/141,434	June 29, 1999	No

I hereby claim the benefit under Title 35, United States, § 120 of any United States application(s) or any PCT international application designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this

U.S. Parent Application or PCT Parent Number	Parent Filing Date Day/Month/Year Filed	Parent Patent Number (if applicable)
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